

Claims

[c1] 1. An emergency lighting equipment with an automatic battery charge/discharge and monitoring system for providing emergency illumination when an alternating current (ac) power source stops providing an ac voltage, the emergency lighting equipment comprising:

an operating module control circuit coupled to the ac power source for receiving and re-transmitting the ac voltage and outputting an operating mode signal;

a rectify/voltage-divide and voltage regulation circuit coupled to the operating mode control circuit for converting the ac voltage from the operating mode control circuit to a direct current (dc) voltage;

a battery for holding electric energy;

a main control unit coupled to the battery, the rectify/voltage-divide and voltage regulation circuit and the operating mode control circuit for receiving the operating mode signal from the operating mode control circuit and the dc voltage from the rectify/voltage-divide and voltage regulation circuit, determining the current operating mode according to the operating mode signal, determining if the ac power source still provides an ac voltage according to the dc voltage and charging or discharging

the battery accordingly, and furthermore, discharging the battery if the ac power source has provided an ac voltage continuously for a preset period of time during which there is no battery discharge; and an illuminating apparatus coupled to the main control unit and the battery, wherein the illuminating apparatus is triggered when the battery discharges and the illuminating apparatus is shutdown by the main control unit when the battery is over-discharged.

- [c2] 2. The emergency lighting equipment of claim 1, wherein the main control unit furthermore comprises:
 - an analogue/digital circuit coupled to the battery for measuring the battery power and outputting a measurement signal;
 - a micro-controller coupled to the analogue/digital circuit for receiving the measurement signal and outputting a charge signal or a discharge signal accordingly, wherein the micro-controller also has a timer for timing the passage of the preset period with ac voltage but without any battery discharge and outputting a discharge signal at the end of the preset period;
 - a charge control circuit coupled to the micro-controller and the battery for receiving the charge signal to initiate a battery charging operation; and
 - a discharge control circuit coupled to the illuminating

apparatus, the micro-controller and the battery for receiving the discharge signal and initiating a battery discharge operation, and furthermore, outputting a shutdown signal to the illuminating apparatus to switch off the illuminating apparatus when the battery is over-discharged.

- [c3] 3. The emergency lighting equipment of claim 2, wherein the discharge control circuit comprises a pulse width modulation device for controlling the size of current when the battery discharges and the duration of the battery discharge.
- [c4] 4. The emergency lighting equipment of claim 1, wherein the rectify/voltage-divide and voltage regulation circuit furthermore comprises:
 - a rectify/voltage-divide circuit coupled to the operating mode control circuit and the micro-controller for converting the ac voltage into a dc voltage; and
 - a constant voltage source coupled to the rectify/voltage-divide circuit and the charge control circuit for receiving the dc voltage and outputting the dc voltage as the constant voltage.
- [c5] 5. The emergency lighting equipment of claim 1, wherein the equipment additionally comprises a battery state inspection circuit coupled to the micro-controller and the

battery for issuing a warning signal when the battery is found to be defective.

- [c6] 6. The emergency lighting equipment of claim 5, wherein the equipment additionally comprises a battery state warning device coupled to the micro-controller for issuing a warning and triggered by the micro-controller when the micro-controller receives the warning signal.
- [c7] 7. The emergency lighting equipment of claim 5, wherein the battery state inspection circuit uses an open-circuit method or a Fourier method of operation.
- [c8] 8. The emergency lighting equipment of claim 1, wherein the equipment additionally comprises a security monitor circuit coupled to the micro-controller and the ac voltage for monitoring and recording images when the ac power source stops providing an ac voltage.
- [c9] 9. The emergency lighting equipment of claim 8, wherein the security monitor circuit furthermore comprises:
 - an image-capturing device coupled to the ac voltage for initiating image recording and outputting the image data after the ac power source has stopped providing an ac voltage;
 - a wireless local network coupled to the micro-controller and the image-capturing device such that the micro-

controller controls the wireless transmission of data captured by the image-capturing device; and a wireless transceiver for receiving the image data transmitted through wireless transmission.

- [c10] 10. The emergency lighting equipment of claim 9, wherein the wireless transceiver comprises a personal computer.
- [c11] 11. The emergency lighting equipment of claim 9, wherein the wireless transceiver comprises a notebook computer.
- [c12] 12. The emergency lighting equipment of claim 9, wherein the wireless transceiver comprises a personal digital assistant.
- [c13] 13. The emergency lighting equipment of claim 1, wherein the preset period is set to 90 days.
- [c14] 14. The emergency lighting equipment of claim 1, wherein the equipment additionally comprises an ac power source indicator light coupled to the rectify/voltage-divide and voltage regulation circuit for indicating the presence or absence of an ac voltage supply.
- [c15] 15. The emergency lighting equipment of claim 1, wherein the illuminating apparatus uses a light-emitting

diode as a source of illumination.

- [c16] 16. The emergency lighting equipment of claim 1, wherein the operating mode control circuit furthermore comprises a button for setting the operating mode into an automatic mode, a manual mode or a shutdown mode.
- [c17] 17. A discharging method for an emergency lighting equipment with an automatic charge/discharge and monitoring system that couples with an alternating current (ac) power source and has at least a battery, the method comprising the steps of:
 - discharging the battery when the ac power source has provided an ac voltage to the emergency lighting equipment continuously for a preset period of time during which there is no battery discharge; and
 - discharging the battery when the ac power source stops providing an ac voltage and at the same time the battery power has reached a discharge cut-off voltage.
- [c18] 18. The discharging method of claim 17, wherein the discharge cut-off voltage is set to about 5.3V.
- [c19] 19. The discharging method of claim 17, wherein the preset period is set to 90 days.
- [c20] 20. A method of charging an emergency lighting equip-

ment with an automatic charge/discharge and monitoring system having a least a battery, the method comprising the steps of:

charging the battery using a constant voltage source when the measured battery power level is smaller than a charge voltage; and
terminating the battery charging operation when the battery power level is greater than a saturated voltage.

- [c21] 21. The charging method of claim 20, wherein the charge voltage is set to about 5.3V.
- [c22] 22. The charging method of claim 20, wherein the constant voltage is set to at least 7.5V.
- [c23] 23. The charging method of claim 20, wherein the saturated voltage is set between 6.6V to 7.3V.